User's Manual



AQ7270 Series OTDR Operation Guide

Foreword

Thank you for purchasing the AQ7270 Series (AQ7270/AQ7275) OTDR (Optical Time Domain Reflectometer). The purpose of this operation guide is to familiarize the first-time user with the basic operations of the AQ7270 Series.

There are two additional user's manuals for the AQ7270 Series OTDR. One is the user's manual (IM735020-01E, CD-ROM) which explains all the functions. The other is the communication interface user's manual (IM735020-17E, CD-ROM) which details the communication functions. Read these manuals along with this operation guide.

Notes

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- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.

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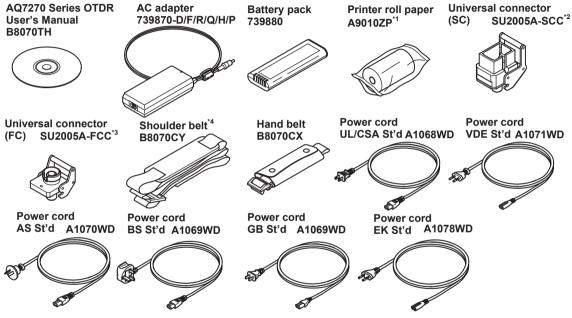
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Revisions

1st Edition: January 2007 2nd Edition: December 2007 3rd Edition: December 2008 4th Edition January 2009 5th Edition June 2009 6th Edition September 2011

Standard Accessories

The standard accessories below are supplied with the instrument.



- *1 Included if the suffix code is /PL.
- *2 Included if the suffix code is -USC.
- *3 Included if the suffix code is -UFC.
- *4 Included if the suffix code is /SB.

Optional Accessories

The optional accessories below are available for purchase separately.

Name	Part Number	Notes
Soft carrying case	739860	Soft case
Emulation software	735070	Waveform analysis application
Printer roll paper	A9010ZP	80 mm width × 25 m roll: 10 rolls per unit
Battery pack (spare)	739880	
External Large Capacity Battery	739881	Attached Connecting Cord and Battery case
AC adapter (spare)	739870-D	UL/CSA standard
	739870-F	VDE standard
	739870-R	AS standard
	739870-Q	BS standard
	739870-H	GB standard, Complied with CCC
	739870-P	EK standard
Shoulder belt	B8070CY	
Universal adapter (SC)	SU2005A-SCC	SC type
Universal adapter (FC)	SU2005A-FCC	FC type

How to Use the CD-ROM (User's Manuals)

The CD-ROM contains PDF files of the following manuals.

- AQ7270 Series OTDR User's Manual IM 735020-01E
- AQ7270 Series OTDR Communication Interface User's Manual IM 735020-17E

To view the above manuals, you need Adobe Reader 5.0 or later.

WARNING

Never play this CD-ROM on an audio CD player. Doing so may cause loss of hearing or speaker damage due to the large sounds that may be produced.

Precautions

To use the instrument safely and effectively, be sure to observe the precautions given in the user's manual. Not complying might result in injury or death.



WARNING

- Use the Correct Power Supply
 - Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the AC adapter and that it is within the maximum rated voltage of the provided power cord.
- Use the Power Cord and AC Adapter Correctly
 Use only the power cord or AC adapter that comes with the instrument. Do not use it for other devices.
- Use Only the Designated Battery pack
 Use only the battery pack specified for the instrument. Do not use it for other devices. Use only this instrument or a charger specified by YOKOGAWA to charge the battery pack. If the fast charge does not finish after three hours or more, stop charging the battery pack immediately. Because the electrolyte solution inside the battery pack is alkaline, harm can be done to the clothes or skin, if the battery pack leaks or explodes and the solution comes in contact. If the electrolyte solution enters the eye, it can cause blindness. If this happens, rinse thoroughly with water and immediately consult your eye doctor. To prevent the possibility of electric shock and accidents, always turn OFF the power switch and remove the AC adapter power supply from the instrument when replacing the battery pack. Do not throw the battery pack into fire or apply heat to it. This can cause dangerous explosions or spraying of the electrolytes.
- · Do Not Look at the Laser Light
 - Do not look at the laser's direct ray, reflected ray from a mirror, or indirect ray without the proper protective eyewear. In addition, avoid being exposed to the laser light. It can cause blindness or damage to the eye. Attach the cover on unused optical connectors.
- Do Not Operate in an Explosive Atmosphere
 Do not use the thermocouple in a location where any flammable or explosive gas/vapor is present. Operation in such an environment constitutes a safety hazard.
- Apply Correct Signals to the Optical Connectors (PORT1 and PORT2)
 Do not apply light that is —5 dBm or greater to the AQ7270/AQ7275 optical connectors (PORT1 and PORT2).
 Doing so may damage the AQ7270/AQ7275.

See below for operating environment limitations.

CAUTION

This product is a Class A (for industrial environments) product. Operation of this product in a residential area may cause radio interference in which case the user will be required to correct the interference.

Overdischarging

If you do not use the AQ7270/AQ7275 for a long time with the battery pack loaded, the battery pack may become overdischarged. Please note that this can lead to reduced life of the battery pack. If you do not plan to use the AQ7270/AQ7275 for longer than a week, prevent overdischarging by charging the battery pack, removing it from the AQ7270/AQ7275, then store it away from sunlight in a 10–30°C environment.

Description of Symbols

The following symbols are used on this instrument.



Warning: handle with care. Refer to the user's manual or service manual. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in the manual to identify those instructions.





Recycle



Equipment protected throughout by double insulation or reinforced insulation



Directive 2002/96/EC

This product complies with the WEEE Directive (2002/96/EC) marking requirement.

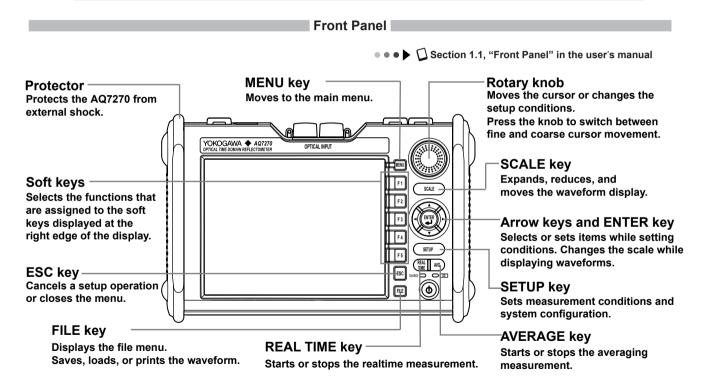
For details on each item, see the respective chapter or section in the user's manual indicated by the • • • • 🗖 mark.

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Names and Functions of Parts



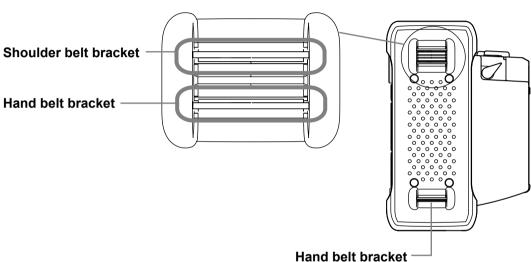
☐ Section 1.3, "Side Panel" in the user's manual Printer paper feed button Internal printer Prints waveforms and event lists. Ethernet connector Used for remote control. Release lever Printer/LAN Release the front cover (factory option) lock. **Battery storage** Stores the accessory battery pack. DC power connector -USB (Type A) **USB** (Type B) Connects the accessory AC adapter. Connects an external Connects to a PC for remote memory or printer. control and reading/writing Measurement port to the internal memory. Outputs an optical signal during the optical pulse test (OTDR).

Receives an optical signal when operating as a power monitor.

Top Panel

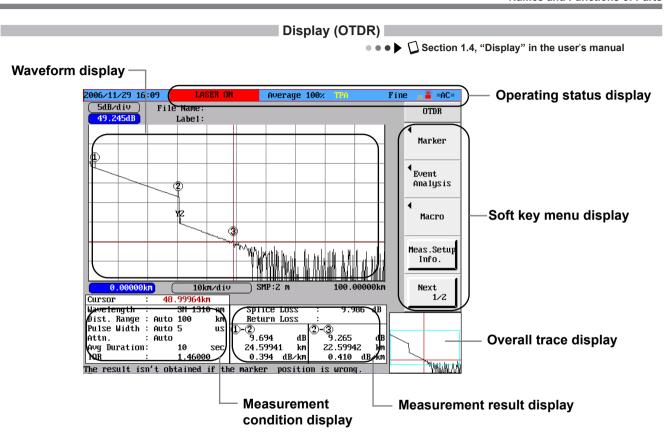
Side Panel

● ● ▶ ☐ Section 1.3, "Side Panel" in the user's manual





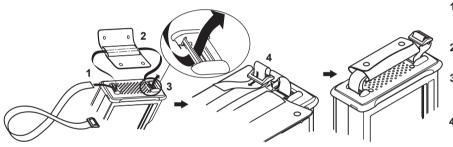
• For the procedure to attach the belt, see page 12.



Preparation

Attaching the Belt

Attaching the Hand Belt



- Pass the hand belt through the lower hand belt bracket on the side of the instrument.
- 2. Pass the hand belt through the hand belt cover.
- Pass the hand belt through the upper hand belt bracket (the second attachment section from the top) on the side of the instrument.
- 4. Pass the hand belt through the buckle and fasten the button.

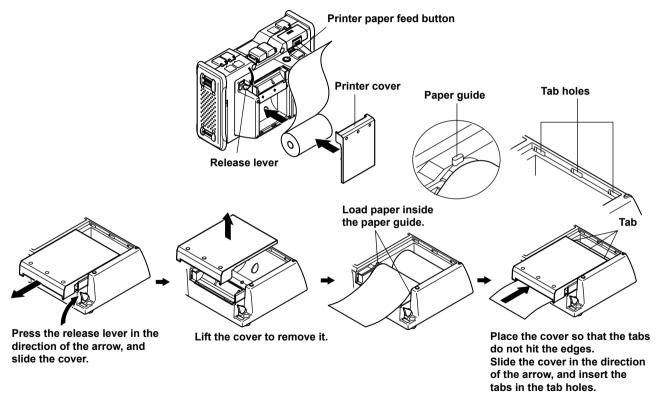
Attaching the Shoulder Belt

- Pass the belt through the buckle again so that it does not come loose.



Attach the shoulder belt to the shoulder belt bracket on the left and right sides of the AQ7270. There are two shoulder belt brackets at the upper section of the side of the instrument. As shown in the figure, securely attach the shoulder belt by passing the belt through the top belt bracket on each side of the instrument and then pass it through the buckle.

Loading the Printer Roll Paper

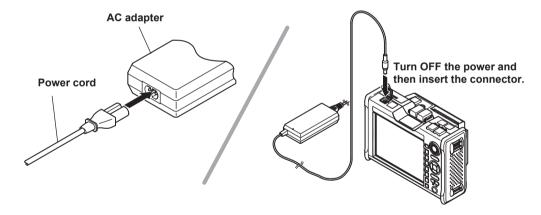


Connecting the Power Supply

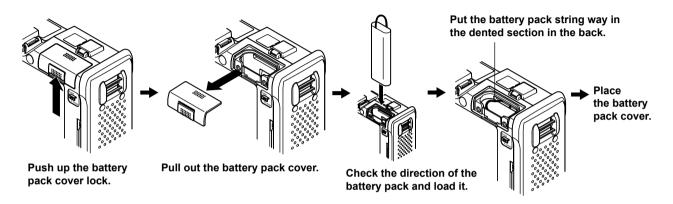


To use the AQ7270 in a safe manner, read the warnings given in section 3.1, "Connecting the Power Supply" in the user's manual before connecting the power supply.

Using the AC Adapter



Loading the Battery Pack



Turning the Power ON

 $\boldsymbol{\mathsf{A}}$ warning message appears when the battery level is low.

If you see the message, charge the battery pack. The battery level is displayed at the top section of the screen.



POWER lamp

Green: Running

Red: Low battery level

CHARGE lamp

Green: Fast charging

in progress
Green (blinking): Fast charging

not started

OTDR

Advanced Analysis

Trace Fix

Battery level indicator
Full (green)

About half (yellow)

Low (red)

Connecting the Optical Fiber Cable

Clean the connector end face of the optical fiber cable under measurement before connecting it to the AQ7270.

If dust is adhered to the connector end face, it may damage the optical connector of the AQ7270. If this happens, the AQ7270 will not be able to make correct measurements.

1. 2. 3. 4.

 Press the connector end face of the optical fiber cable firmly against the cleaning surface of the cleaner.

Turn the cable around once with the end face pressed against the cleaner.

- 3. Rub the end face against the cleaner.
- 4. Repeat steps 1 to 3.

You can purchase an optical fiber connector cleaner from NTT-AT Corporation.

- 1. Open the optical connector cover at the top of the AQ7270.
- 2. Match the direction of the optical fiber cable connector to the optical connector, and insert it.



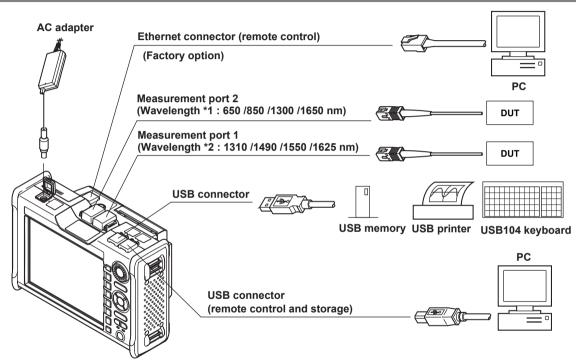
• The connector to which the cable is to be connected varies depending on the wavelength. Connect the cable to the connector that is indicated by the red indicator at the top of the AQ7270 display.

Optical pulse output indicator

urse = =AC=

Setup

Configuration of Peripheral Devices



^{*1} The 735021 outputs 1650 nm from PORT1. The 735029 outputs 850 nm and 1300 nm from PORT1. The /PM option supports only PORT1. PORT2 (MMF) and 1650-nm wavelength are not supported.

IM 735020-02E

^{*2} The 735036 outputs 1625 nm from PORT2.

Setting the Measurement Conditions

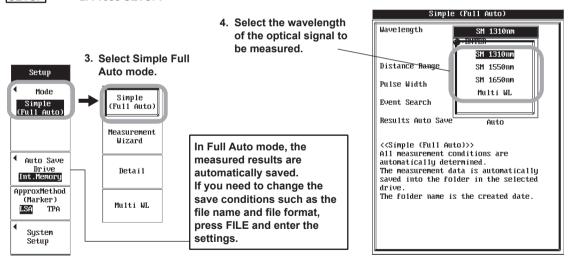
Setting the Simple Mode

• • • Section 4.1, "Selecting the Test Wavelength" in the user's manual

In Simple (Full Auto) mode, you can easily make measurements simply by setting the wavelength.

OTDR 1. Press the OTDR soft key.

SETUP 2. Press SETUP.





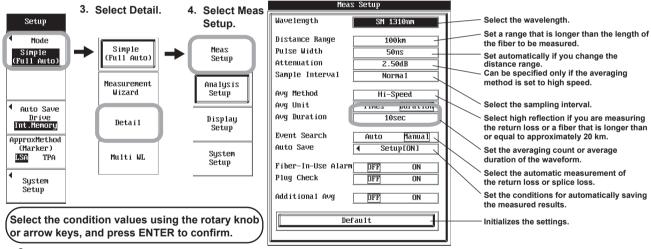
► ☐ Section 6.1, "Setting the Measurement Conditions" in the user's manual

You can set the measurement conditions in detail according to the DUT. 1. Press the OTDR soft kev.

SETUP 2. Press SETUP.

OTDR |

5. Move the cursor to the item you want to set, and press ENTER.





· You can set the AQ7270 manually in the same way also in measurement wizard and multi wavelength modes. In measurement wizard mode, a screen containing an explanation of items is displayed when setting the conditions.

Making Measurements

Making Measurements Automatically

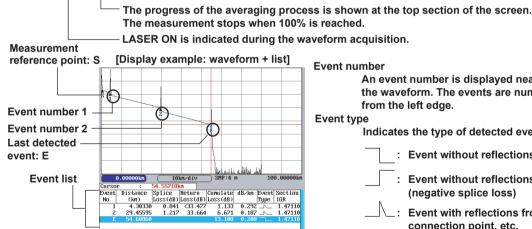
• • • Section 12.1, "Viewing the Measured Results" in the user's manual

If the setup mode was set to Simple on page 18 or if the event search was set to Auto on page 191

1. Press AVE. AVE

40%

The measurement starts. The AQ7270 performs averaging and then automatically detects the return loss and splice loss. The AQ7270 displays the detected events on the screen and stops the measurement. If you press AVE again while waveform acquisition is in progress, the measurement stops at that point.



Event number

An event number is displayed near an event on the waveform. The events are numbered in order from the left edge.

Event type

Indicates the type of detected event.

- Event without reflections from fused points, etc.
- Event without reflections from fused points, etc. (negative splice loss)
- Event with reflections from the connector connection point, etc.

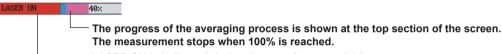
Performing Averaging and Viewing Waveforms

● ● ► ☐ Section 7.2, "Averaging Measurement" in the user's manual

[If the event search was set to Manual on page 19]

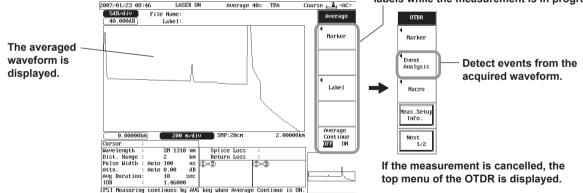
AVE 1. Press AVE.

The measurement starts. The AQ7270 performs averaging and stop the measurement. If you press AVE again while waveform acquisition is in progress, the measurement stops at that point.



LASER ON is indicated during the waveform acquisition.

You can only operate the markers and edit the labels while the measurement is in progress.



Viewing Waveforms in Realtime

• • • Section 7.1, "Realtime Measurement" in the user's manual

REAL TIME 1. Press REAL TIME.

The measurement starts. Press REAL TIME again to stop the measurement.

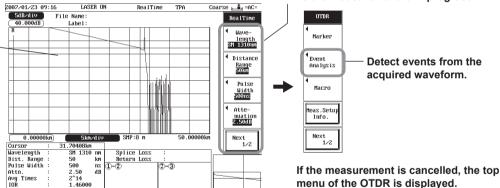


LASER ON is indicated during the waveform acquisition.

[F5][Next1/2] can set marker and measurement range.

You can change the measurement conditions while the measurement is in progress.

Constantly updates the waveform while the measurement is in progress.



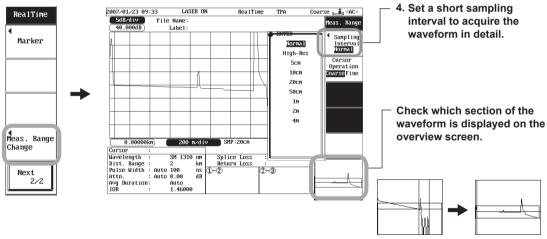
Viewing High-Resolution Waveforms in Realtime

• • • Section 7.4, "High Resolution Measurement of the Selected Location" in the user's manual

* Cannot be used in Simple (Full Auto) mode.

Meas. Range Change

- 1. Press REAL TIME.
- 2. Press the Meas. Range Change soft key. (Page 2/2 of the soft key menu) The waveform is acquired at the selected sampling interval (up to 50,000 points) around the marker displayed on the screen.
 - 3. Move the marker to the location of the waveform you want to view in detail.



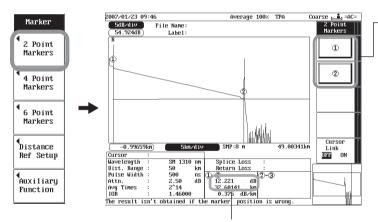
If you set a short sampling interval, the range defined by sampling interval × 50,000 points is displayed on the screen.

Measuring the Distance and Loss between Two Points

• • • Section 10.1, "Measuring the Distance from the Instrument" in the user's manual.

Markers 1. Press

- 1. Press the Marker soft key.
- 2. Press the 2 Point Markers soft key.
- 3. Turn the rotary knob to the right to display the cursor.



4. Markers

Move the cursor to the start point of the distance measurement, and press the \odot soft key. Move the cursor to the end point of the distance measurement, and press the ② soft key.

* If you are measuring the loss and there are events (connection points) between ① and ②, set the marker approximation to TPA.

You can change the marker approximation method using Approx.Method (Marker) in the analysis setup of the detail setup mode.

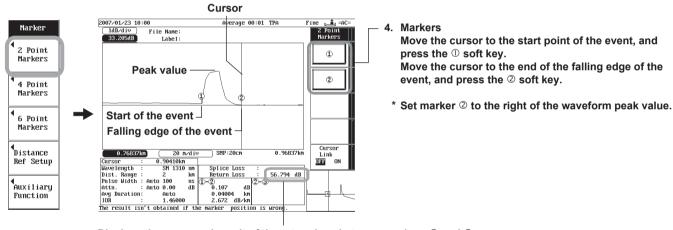
Displays the distance between markers \odot and \odot and the measured result of the loss (loss and distance displayed in the first and second lines, respectively).

Measuring the Return Loss

• • • Section 11.4, "Measuring the Return Loss and Reflection Level" in the user's manual

Markers 2 Point Markers

- 1. Press the Marker soft key.
- 2. Press the 2 Point Markers soft key.
 - 3. Turn the rotary knob to the right to display the cursor.



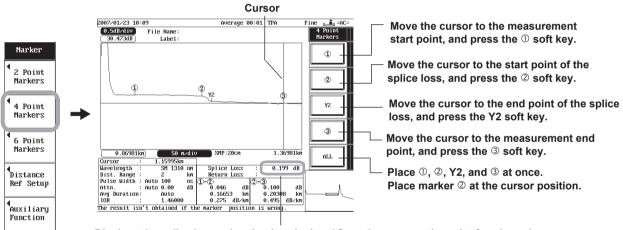
Displays the measured result of the return loss between markers $\ensuremath{\mathbb{O}}$ and $\ensuremath{\mathbb{O}}.$

Measuring the Splice Loss

● ● ► ☐ Section 11.2, "Measuring the Splice Loss" in the user's manual

Markers 4 Point Markers

- 1. Press the Marker soft key.
- 2. Press the 4 Point Markers soft key.
- 3. Turn the rotary knob to the right to display the cursor.



Displays the splice loss value that is calculated from the measured result of each marker.

Making One-Button Measurements

• • • Section 9.4, "Executing the Macro" in the user's manual

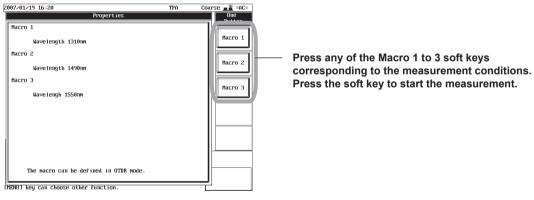
MENU -

■ 1. Press MENU.

One Button 2. Press the One Button soft key.

One-button measurement requires the measurement conditions to be registered (macro definition) in advance.

For the setup procedure, see section 9.1, "Creating the Measurement Conditions (Defining the Macro Conditions)" in the user's manual.



Measuring Multicore Fiber

1 Press MFNU

Multicore Fiber Mean

2. Press the Multicore Fiber soft key.

3. Selecting the project file (New Project, Previous Project or Recall Project File).

Multicore fiber measurement requires the project (Multicore fiber measurement condition) file to be set in advance.

For the setup procedure, see section 7.5, "Measuring Multicore Fiber" in the user's manual.

New Project

MENU

- 4. Press the New Project soft key.
 You can set the item below in the project setting screen.
 - Project Name
 - Destination Drive
 - Destination Folder



5. Press the Next soft key.

You can set the measurement start number and the number of cores in the Fiber Information screen.



6. Press the Next soft key.

You can specify wavelength which measures the fiber in the Wave Length screen.

☐ Section 7.5, "Measurering Multicore Fiber" in the user's manual



7. Press the Next soft key.

You can set the save file name in the File Setup screen.



- 8. Press the Next soft key. The Alart screen appears.
 - You can select whether to enter the detailed measurement condition.

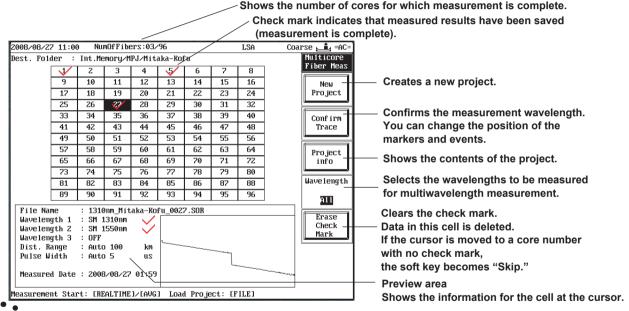
For the detailed measurement condition, see section

7.5, "Measureing Multicore Fiber" in the user's manual.

Main View Screen

The main view screen is where the contents of a project are listed.

Select the core number in the main view screen and you can perform the real time measurement or the averaged measurement. As with normal OTDR mode, you can continue on from real time measurement to perform averaged measurement.



™ Note

The settings used when not entering detailed settings are as follows.

Distance range: Auto, Pulse width: Auto, Attenuation: Auto, Avg Method: Hi-Reflection, Avg Unit: Duration, Avg Duration: Auto, Event Search: Auto, Auto Save: ON, Fiber-In-Use Alarm: ON, Plug Check: OFF

Expanding the Waveform and Moving the Display Area

● ● ► ☐ Section 8.1, "Zooming the Display" in the user's manual

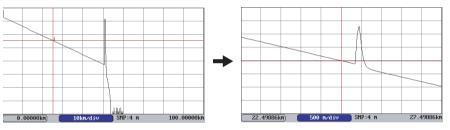
Expand

SCALE

1. Press SCALE.

Zoom

- 2. Press the Zoom soft key.
 - 3. Turn the rotary knob to move the cursor to the point on the waveform you want to expand.
 - 4. Press the arrow keys to expand or reduce the waveform.
 - Expand the waveform vertically.
- ↑: Reduce the waveform vertically.
- ←: Expand the waveform horizontally. →: Reduce the waveform horizontally.



Normal scale

Zoom scale

Moving the display area

- Shift 2. Press the Shift soft key.
 - 3. Turn the rotary knob to move the cursor to the point on the waveform you want to move.
 - 4. Press the arrow keys to move the waveform.
 - 1: Move the display area down. ↑: Move the display area up.
 - \leftarrow : Move the display area to the left. \rightarrow : Move the display area right.

Check the zoom position of the waveform on the overview screen.



The waveform display area (the section enclosed in a square) within the entire screen moves.



Printing/Saving Waveforms

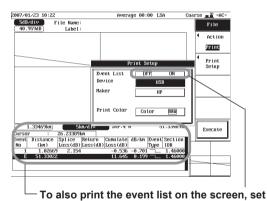
● ● ▶ 🔲 18.5, "Printing Waveforms" in the user's manual

Printing

FILE ______1. Press FILE.

Action 2. Press the Action soft key.

3. From the item list, select Print.



the Event List setting to ON.

Print Setup 4. Select the internal printer or any external printer.

Execute 5. Press the Execute soft key to print.

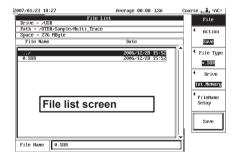
• • D 18.1, "Loading and Saving Waveforms" in the user's manual

Saving

FILE 1. Press FILE.

Action 2. Press the Action soft key.

3. From the item list, select Save.



File Type 4. Select the desired file type.

Drive 5. Set the save destination to the internal memory or USB memory.

FileName Setup 6. Set the file name as necessary.

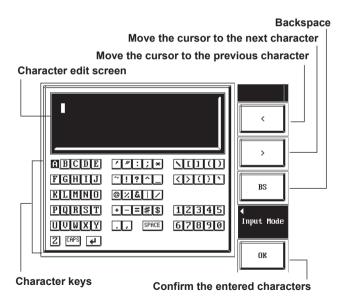
7. Press the Save soft key to save the file.

Entering Characters

You can enter file names and comments from the character input screen shown below when saving the measured waveforms.

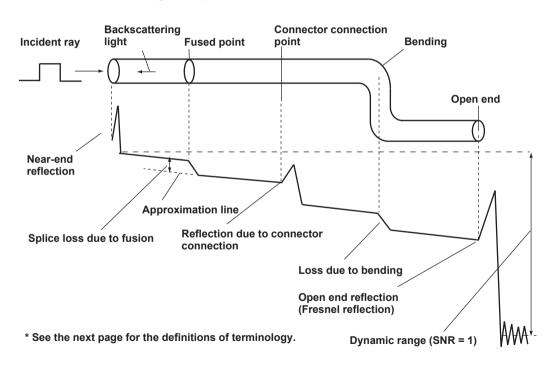
Character Input Screen

● ● ▶ ☐ Section 18.6, "Entering Characters" in the user's manual



Background Information on Measurements

Viewing the Optical Pulse Measurement Waveform



Background Information on Measurements

Terminology

Near-end reflection

A reflection occurs in the gap between the AQ7270 and the connector for the optical fiber cable. Losses and reflections of the connection points cannot be detected in the section in which this reflection is detected. This section is called a dead zone.

Backscattering light

When light propagates through the optical fiber cable, a phenomenon called Rayleigh Scattering occurs due to the nonuniformity of the density or constituents of materials smaller than the wavelength unit. The scattered light that is transmitted opposite to the direction of propagation is called backscattering light.

Splice loss due to fusion

A splice loss occurs at the fused section mainly due to axis offset and angle offset.

Reflection due to connector connection

Unlike the fused section, a slight gap occurs in the connection section of connectors. Because the group refraction index changes in this gap, a reflection occurs causing a loss.

Fresnel reflection at the far end of the optical fiber cable

Fresnel reflection occurs at the location where the optical fiber cable is broken or a location where the group refraction index changes such as the far end of the cable (glass and air) when light enters the cable. If the end face of the optical fiber cable is vertical, approximately 3.4 % (–14.7 dB) of the incident light power is reflected.

Dynamic range

Dynamic range refers to the difference between the backscattering light level at the near end and the noise (RMS = 1).

Dead zone

The locations where measurements cannot be made due to the effects of Fresnel reflection, connection point of connectors, etc.

Specifications

MODEL

MODEL	Suffix Code	Description
735020		1550 nm, 32 dB
735021		1650 nm, 28 dB
735022		1310/1550 nm, 34/32 dB
735023		1310/1550 nm, 40/38 dB
735024		1550/1625 nm, 38/35 dB
735025		1310/1490/1550 nm, 34/30/32 dB
735026		1310/1550/1625 nm, 34/32/28 dB
735027		1310/1550/1650 nm, 34/32/28 dB
735028		1310/1550/1625 nm, 40/38/35 dB
735029		850/1300 nm, 22.5/24 dB (Gl(62.5/125 μm))
735030		850/1300 nm, 22.5/24 dB (Gl(62.5/125 μm))
		1310/1550 nm, 34/32 dB

AQ7275

MODEL	Suffix Code	Description
735031		1650nm, 30dB (15 dB if the suffix code is /PN)
735032		1310/1550 nm, 34/32 dB (36/34 dB if the suffix code is /DR)
735033		1310/1550 nm, 40/38 dB (23/21 dB if the suffix code is /PN)
735034		1310/1550nm, 43/41dB
735035		1310/1490/1550nm, 34/30/32dB
735036		1310/1550/1625nm, 40/38/33dB (23/21/16 dB if the suffix code is /PN)
735037		1310/1550/1650 nm, 40/38/30 dB
735038		1310/1550/1625nm, 40/38/35dB (23/21/16 dB if the suffix code is /PN)
735040		850/1300 nm, 22.5/24dB (GI(62.5/125 μm))
		1310/1550 nm, 40/38 dB
735041		850/1300 nm, 21.5/23dB (GI(50/125 μm)), 22.5/24dB (GI(62.5/125 μm))
		1310/1550nm, 40/38dB

AQ7270/AQ7275

Item	Suffix Code	Description
Optical connector	-SCC	SC connector (fixed)
•	-FCC	FC Connector (fixed)
	-ASC	Angled PC SC Connector *1
	-NON	No universal adapter
	-USC	SC universal adapter
	-UFC	FC universal adapter
Language	-HE	English
	-HC	Chinese/English
	-HK	Korean/English
	-HR	Russian/English
Power cord	-D	UL/CSA standard Max. rated voltage: 125 V
	-F	VDE standard Max. rated votlage: 250 V
	-R	AS standard Max. rated votlage: 250 V
	-Q	BS standard Max. rated votlage: 250 V
	-H	GB standard Max. rated votlage: 250 V
	-P	EK standard Max. rated votlage: 250 V
Options	/PM	Optical power monitor function ^{'2}
	/SLS	Stability Light source function ¹³
	/LS	Light source function ⁴
	/VLS	Visible Light source function *5
	/PL	Internal printer and LAN (Ethernet interface)
	/DF	Dummy fiber (SMF) ¹⁶
	/SB	Shoulder belt
	/DR	Dynamic range expansion (2 dB) ⁷
	/PN	PON measurement *8

^{*1} Supported by the SMF port of the 735031, 735032, 735033, 735034, 735035, 735036, 735037, 735038, 735040 and 735041, or supported by the visible light source output port of the 735031, 735032, 735033, 735034, 735035 and 735038.

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^{*2} Not supported by 735021, 735029 and 735031, and the MMF of 735030, 735040 and 735041.

^{*3} Not supported by 735029 to 735030, and 735040.

^{*4} not supported by 735029, 735032, 735033, 735037, and the MMF of the 735030 and 735040.

^{*5} Supported by 735031, 735032, 735033, 735034, 735035 and 735038.

^{*6} not supported by 735029, 735030, 735040 and 735041.

^{*7} Supported by 735032

^{*8} Supported by 735031, 735033, 735036 and 735038

Ontical Specifications

Optical power monitor (input level)
Optical power monitor (accuracy)³

Optical Specifications		
MODEL: 735020		
Center wavelength	1550 nm ± 25 nm	
Applicable fiber	SM (ITU-T G.652)	
Event dead zone*5,11	0.8 m (max.)	
Attenuation dead zone*6,11	8 m (typ.)	
Dynamic range (min.)*4	32 dB	
Light source (optical output)	–5 dBm or more (/LS option)	
Optical power monitor (input level)	-50 dBm to -5 dBm (/PM option)	
Optical power monitor (accuracy)*3	±0.5 dB (/PM option)	
MODEL: 735021 /735031		
Center wavelength	1650 nm ± 5 nm ⁻¹ , 1650nm ±10 nm ⁻²	
Measuring pulse optical output	≤15 dBm (max.) (excluding 735031 /PN option)	
Applicable fiber	SM (ITU-T G.652)	
Event dead zone*5,11	0.8 m (max.) (0.8m(Typ) if the suffix code is 735031 /PN)	
Attenuation dead zone*6,11	12 m (typ.)	
Dynamic range (min.)*4.10	30 dB(15 dB if the suffix code is /PN)*15	
Light source (optical output)	–5 dBm or more (735021 /LS option, 735031 /SLS option)	
Light source (output level stability)	±0.15 dB (735031 /SLS option)	
MODEL: 735022 /735032		
Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm	
Applicable fiber	SM (ITU-T G.652)	
Event dead zone*5,11	0.8 m (max.)	
Attenuation dead zone*6,11	7 m (typ.)@1310 nm, 8 m(typ.)@1550 nm	
Dynamic range (min.)*4	34 dB@1310 nm, 32 dB@1550 nm	
3 ()	36 dB@1310 nm, 34 dB@1550 nm (735032 /DR option)	
Light source (optical output)	-5 dBm or more (735022 /LS option, 735032 /SLS option)	
Light source (output level stability)	±0.1 dB (735032 /SLS option)	

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-50 dBm to -5 dBm (/PM option)

±0.5 dB (/PM option)

MODEL: 735023 /735033	
Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm
Applicable fiber	SM (ITU-T G.652)
Event dead zone*5,11	0.8 m (max.) (0.8m(Typ.) if the suffix code is 735033 /PN)
Attenuation dead zone*6,11	7 m (typ.)@1310 nm, 8 m(typ.)@1550 nm
Dynamic range (min.)*4	40 dB@1310 nm, 38 dB@1550 nm, 23dB@1310nm(735033 /PN option)*15
	21dB@1550nm(735033 /PN option)*15
Light source (optical output)	-5 dBm or more (735023 /LS option, 735033 /SLS option)
Light source (output level stability)	±0.1 dB (735033 /SLS option)
Optical power monitor (input level)	−50 dBm to −5 dBm (/PM option)
Optical power monitor (accuracy)*3	±0.5 dB (/PM option)
MODEL: 735024 /735034	
Center wavelength	1550 nm ± 25 nm (735024), 1625 nm ± 25 nm (735024)
	1310 nm ± 25 nm (735034), 1550 nm ± 25 nm (735034)
Applicable fiber	SM (ITU-T G.652)
Event dead zone*5,11	0.8 m (max.)
Attenuation dead zone*6,11	8 m (typ.)@1550 nm (735024), 12 m(typ.)@1625 nm (735024)
	7 m (typ.)@1310 nm (735034), 8 m(typ.)@1550 nm (735034)
Dynamic range (min.)*4	38 dB@1550 nm (735024), 35 dB@1625 nm (735024)
	43 dB@1310 nm (735034), 41 dB@1550 nm (735034)
Light source (optical output)	-5 dBm or more (735024 /LS option, 735034 /SLS option)
Light source (output level stability)	±0.1 dB (735034 /SLS option)
Optical power monitor (input level)	-50 dBm to -5 dBm@1310/1550 nm (/PM option)
Optical power monitor (accuracy)*3	±0.5 dB@1310/1550 nm (/PM option)

MODEL: 735025 /735035	
Center wavelength	1310 nm ± 25 nm, 1490 nm ± 25 nm, 1550 nm ± 25 nm
Applicable fiber	SM (ITU-T G.652)
Event dead zone*5,11	0.8 m (max.)
Attenuation dead zone*6,11	7 m (typ.)@1310 nm, 8 m (typ.)@1490 nm, 8 m (typ)@1550 nm
Dynamic range (min.)*4	34 dB@1310 nm, 30 dB@1490 nm, 32 dB@1550 nm
Light source (optical output)	–5 dBm or more (735025 /LS option, 735035 /SLS option)
Light source (output level stability)	±0.1 dB (735035 /SLS option)
Optical power monitor (input level)	−50 dBm to −5 dBm (/PM option)
Optical power monitor (accuracy)*3	±0.5 dB (/PM option)
MODEL: 735026 /735036 Center wavelength Measuring pulse optical output Applicable fiber Event dead zone*5,11 Attenuation dead zone*6,11 Dynamic range (min.)*4	1310 nm ± 25 nm, 1550 nm ± 25 nm, 1625 nm ± 25 nm ≤15 dBm (max.) @1625nm(excluding 735036 /PN option) SM (ITU-T G.652) 0.8 m (max.) (0.8m(Typ.) if the suffix code is 735036 /PN) 7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm, 12 m (typ)@1625 nm 34 dB@1310 nm (735026), 32 dB@1550 nm (735026), 28 dB@1625 nm (735026) 40 dB@1310 nm (735036), 38 dB@1550 nm (735036), 33 dB@1625 nm (735036) 23dB@1310nm (735036 /PN option) ¹⁵ , 21dB@1550nm (735036 /PN option) ¹⁵ 16dB@1625nm (735036 /PN option) ¹⁵
Light source (optical output)	-5 dBm or more (735026 /LS option, 735036 /SLS option)
Light source (output level stability)	±0.1 dB (735036 /SLS option)
Optical power monitor (input level)	-50 dBm to -5 dBm@1310/1550 nm (/PM option)
Optical power monitor (accuracy)*3	±0.5 dB @1310/1550 nm (/PM option)

MODEL: 735027 /735037	
Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm, 1650 nm ± 5 nm ⁻¹ , 1650 nm ± 10 nm ⁻²
Measuring pulse optical output	≤15 dBm (max.)@1650 nm
Applicable fiber	SM (ITU-T G.652)
Event dead zone*5,11	0.8 m (max.)
Attenuation dead zone*6,11	7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm, 12 m (typ)@1650 nm
Dynamic range (min.)*4,10	34 dB@1310 nm (735027), 32 dB@1550 nm (735027), 30 dB@1650 nm (735027)
, ,	40 dB@1310 nm (735037), 38 dB@1550 nm (735037), 30 dB@1650 nm (735037)
Light source (optical output)	-5 dBm or more (735027 /LS option, 735037 /SLS option)
Light source (output level stability)	±0.1 dB@1310/1550 nm (735037 /SLS option)
	±0.15 dB@1650 nm (735037 /SLS option)
Optical power monitor (input level)	-50 dBm to −5 dBm@1310/1550 nm (/PM option)
Optical power monitor (accuracy)*3	±0.5 dB@1310/1550 nm (/PM option)
MODEL: 735028 /735038	
Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm, 1625 nm ± 25 nm
Applicable fiber	SM (ITU-T G.652)
Event dead zone*5,11	0.8 m (max.) (0.8m(Typ.) if the suffix code is 735038 /PN)
Attenuation dead zone*6,11	7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm, 12 m (typ)@1625 nm
Dynamic range (min.)*4	40 dB@1310 nm, 38 dB@1550 nm, 35/36 dB@1625 nm (735028/735038)
	23dB@1310nm (735038 /PN option)*15, 21dB@1550nm (735038 /PN option)*15
	16dB@1625nm (735038 /PN option) ^{™5}
Light source (optical output)	–5 dBm or more (735028 /LS option, 735038 /SLS option)
Light source (output level stability)	±0.1 dB (735038 /SLS option)
Optical power monitor (input level)	-50 dBm to -5 dBm@1310/1550 nm (/PM option)
Optical power monitor (accuracy)*3	±0.5 dB@1310/1550 nm (/PM option)
MODEL: 735029	
Center wavelength	850 nm ± 30 nm, 1300 nm ± 30 nm
Applicable fiber	GI(62.5/125 μm)
Event dead zone*9,11,12	2 m (typ.)
Attenuation dead zone*6,11,12,13	7 m (typ.)@850 nm, 10 m(typ.)@1300 nm
Dynamic range (min.)*8,12	22.5 dB@850 nm, 24 dB@1300 nm

MODEL:	735030	/735040	/735041
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Center wavelength	850 nm ± 30 nm, 1300 nm ± 30 nm, 1310 nm ± 25 nm, 1550 nm ± 25 nm
Applicable fiber	SM (ITU-T G.652) when using the SMF port
	GI (50/125 μm) when using the MMF port (735041)
	GI (62.5/125 μm) when using the MMF port
Event dead zone	2 m (typ.)@850/1300 nm ^{*9,11,12} , 0.8 m@1310/1550 nm ^{*5,11}
	1 m (typ.)@850/1300 nm (735041) ^{*5,11,14}
Attenuation dead zone*6,11,13	7 m (typ.)@850 nm (735030/735040), 6 m (typ)@850 nm (735041), 10 m (typ.)@1300 nm,
	7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm
Dynamic range (min.)*4,8	22.5 dB@850 nm (735030), 24 dB@1300 nm (735030), 34 dB@1310 nm (735030),
	32 dB@1550 nm (735030)
	22.5 dB@850 nm (735040), 24 dB@1300 nm (735040),
	21.5dB@850nm(735041/GI (50 µm)), 22.5dB@850nm(735041/GI (62.5µm)),
	23dB@1300nm(735041/GI (50 µm)), 24dB@1300nm(735041/GI (62.5 µm)),
	40 dB@1310 nm (735040/735041), 38 dB@1550 nm (735040/735041)
Light source (optical output)	-5 dBm or more@1310/1550 nm (735030 /LS option, 735040 /LS option,
	735041 /SLS option)
Light source (output level stability)	±0.1 dB@1310/1550 nm (735041 /SLS option)
Optical power monitor (input level)	-50 dBm to -5 dBm@1310/1550 nm (/PM option)
Optical power monitor (accuracy)*3	±0.5 dB@1310/1550 nm (/PM option)

- *1 ±5 nm: -20 dB point from the peak value of the pulse optical output
- *2 ±10 nm: -60 dB point from the peak value of the pulse optical output

- *3 When applying input with λ = 1310 nm at -10 dBm
- *4 Pulse width 20 µs, distance range 200 km, sampling resolution 32 m, and average duration 3 minutes.
- *5 Pulse width 3 ns. return loss 45 dB or more. 1.5 dB point below the peak value at unsaturated condition.
- *6 Pulse width 10 ns, return loss 45 dB or more, at a point where the backscattering light level is within 0.5 dB of the steady-state value.
- *8 Pulse width 500 ns (850 nm)/1 µs (1300 nm), average duration 3 minutes, and sampling resolution 4 m.
- *9 Pulse width 10 ns, return loss 40 dB or more, at a point where the backscattering light level is within 1.5 dB of the steady-state value.
- *10 1.65 µm: With background light (1550 nm ± 75 nm, 19 dBm, CW light)
- *11 At group reflective index 1.5
- *12 GI (62.5/125 μ m) is measured.
- *13 Pulse width 10 ns, return loss 40 dB or more, at a point where the backscattering light level is within 0.5 dB of the steady-state value.
- *14 Pulse width 3 ns, return loss 40 dB or more, at a point where the backscattering light level is within 1.5 dB of the steady-state value.
- *15 At pulse width 100ns
- The dynamic range values are smaller by 0.5 dB than the above values if the dummy fiber option is used.
- Typical value represents a typical or average value. It is not strictly warranted.
- The ampersand after the values in the optical specifications indicate that the value correspond to the wavelength after the ampersand.
- Please inquire for information on performance when using GI (50/125 μm)

General Specifications

General Specifications	
Item	Specifications
Display	8.4-inch color TFT (640 × 480 dots)
Distance range	500 m, 1 km, 2 km, 5 km, 10 km, 20 km, 50 km, 100 km, 200 km, 300 km, 400 km and 512km ^{*1}
	*1 This parameter covers firm ware versions 3.01 or later of the AQ7270 Series.
Reading resolution	1 cm min.
Sampling resolution	5 cm, 10 cm, 20 cm, 50 cm, 1 m, 2 m, 4 m, 8 m, 16 m, 32 m
Number of data samples	Up to 50000 points
Group refraction index	1.30000 to 1.79999 (0.00001 steps)
Distance unit	km mile and kf for English display
Pulse width	3 ns, 10 ns, 20 ns, 50 ns, 100 ns, 200 ns, 500 ns, 1 μ s, 2 μ s, 5 μ s, 10 μ s, and 20 μ s
	*1 5 μs for 850 nm (GI)
	*2 Exclude 3 ns for 850/1300 nm (GI) of 735029, 735030 and 735040
Distance measurement accuracy	±1 + measured distance × 2 × 10-5 ± sampling resolution
Internal memory	Saves up to 1000 waveforms
USB (1.1)	Type A (printer and external memory)
	Type B (remote and storage)
LAN (option)	10/100BASE-T
Internal printer (option)	576-dot/line thermal printer, chart paper width: 80 mm
AC power supply	100 to 240 VAC 50/60 Hz
Battery pack	Duration: 6 hours (under given usage conditions),
	Charge time: 5 hours (ambient temperature of 23°C, power OFF)
Weight (excluding options)	Approx. 2.8 kg
Dimensions (projections excluded)	287 (W) × 197 (H) × 85 (D)
	287 (W) × 197 (H) × 135 (D) with the /PL option
Temperature range	During use 0°C to 45°C
	During storage —20°C to 60°C
	When using the printer 0°C to 35° 80%RH or less
	When charging the battery pack 0°C to 35° C
Maximum relative humidity	85%RH or less (without condensation)
Storage altitude	3000 m or less
Operating altitude	2000 m or less
Environmental protection	Uses lead-free soldering

Item	Specifications
Emission	
Complying standard	EN61326-1 Class A
	EN55011 Class A, Group 1
	EN61000-3-2
	EN61000-3-3
	This instrument is a Class A (for industrial environment) product. Operation of this product in a
	residential area may cause radio interference in which case the user is required to correct the
	interference.
	C-Tick EN55011 Class A, Group 1
Cable conditions	• USB
	 Use a shielded cable. Use cables of length 3 m or less. Attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA part number: A1190MN) with two windings at the AQ7270 end (see the figure below). Ethernet interface connector Use LAN cables of length 30 m or less. Attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA part number: A1190MN) with two windings at the AQ7270 end (see the figure below).
	USB Cable (Type A) USB Cable (Type B) Ethernet Cable
Immunity	
Complying standard	EN61326-1 Table 2 (For use in industrial locations)
Cable conditions	Same as the cable conditions for emission.
Safety standards	
Complying standard	EN61010-1
	EN60825-1 (Laser Safety)

Specifications Laser Safety

This instrument uses a laser light source. This instrument is a Class 1M laser product as defined by IEC60825-1 Safety of Laser Products-Part 1: Equipment Classification, Requirements and User's Guide. In addition, the AQ7270 complies with 21CFR1040.10 except for the items that deviate from the standard as a result of complying with Laser Notice No.50 dated on June 24, 2007.

Laser Class 1M Label

INVISIBLE LASER RADIATION DO NOT VIEW DIRECTY WITH OPTICAL INSTRUMENTS CLASS 1M LASER PRODUCT (IEC 60825-1:2007) レーザ放射 大学器具で直接ビームを見ないこと。クラス 1M レーザ製品

Laser Class 3R Label

VISIBLE LASER RADIATION AVOID DIRECT EYE EXPOSURE CLASS 3R LASER PRODUCT (IEC 60825-1:2007) MAX OUTPUT WAVELENGTH 5mW 650 ± 20nm レーザ放射 目への直接被ばくをさけること クラス 3R レーザ製品

MODEL	Class	Center Wavelength	Output Power
735020	1M	1550 nm	CW; ≤ 5 mW@1550 nm
			PULSE; ≤ 200 mW@1550 nm
			PULSE width: ≤20 us@1550 nm (duty cycle: ≤2.5%)
735021	1M	1650 nm	CW: ≤ 5 mW@1650 nm
			PULSE: ≤ 32 mW@1650 nm
			PULSE width: ≤20 us@1650 nm (duty cycle: ≤2.5%)
735022	1M	1310/1550 nm	CW: ≤5 mW@1310/1550 nm
			PULSE: ≤200 mW@1310/1550 nm
			PULSE width: ≤20 us@1310/1550 nm (duty cycle: ≤2.5%)
735023	1M	1310/1550 nm	CW: ≤5 mW@1310/1550 nm
			PULSE: ≤200 mW@1310/1550 nm
			Pulse width: ≤20 us@1310/1550 nm (duty cycle: ≤2.5%)
735024	1M	1550/1625 nm	CW: ≤5 mW@1550/1625 nm
			PULSE: ≤200 mW@1550/1625 nm
			Pulse width: ≤20 us@1550/1625 nm (duty cycle: ≤2.5%)

MODEL	Class	Center Wavelength	Output Power
735025	1M	1310/1490/1550 nm	CW; ≤5 mW@1310/1490/1550 nm
			PULSE: ≤200 mW@1310/1490/1550 nm
			Pulse width: ≤20 us@1310/1490/1550 nm (duty cycle: ≤2.5%)
735026	1M	1310/1550/1625 nm	CW; ≤5 mW@1310/1490/1625 nm
			PULSE: ≤200 mW@1310/1490/1625 nm
			Pulse width: ≤20 us@1310/1550/1625 nm (duty cycle: ≤2.5%)
735027	1M	1310/1550/1650 nm	CW: ≤5 mW@1310/1490/1650 nm
			PULSE: ≤200 mW@1310/1550 nm, PULSE: ≤ 32 mW@1650 nm
			Pulse width: ≤20 us@1310/1550/1650 nm (duty cycle: ≤2.5%)
735028	1M	1310/1550/1625 nm	CW: ≤5 mW@1310/1490/1625 nm
			PULSE: ≤200 mW@1310/1490/1625 nm
			Pulse width: ≤20 us@1310/1550/1625 nm (duty cycle: ≤2.5%)
735029	1M	850/1300 nm	PULSE: ≤50 mW@850 nm, PULSE: ≤100 mW@1300 nm
			Pulse width: ≤1 us@850 nm (duty cycle: ≤5%), ≤5 us@1300 nm (duty cycle: ≤0.6%)
735030	1M	850/1300 nm	PULSE: ≤50 mW@850 nm, PULSE: ≤100 mW@1300 nm
			Pulse width: ≤1 us@850 nm (duty cycle: ≤5%), ≤5 us@1300 nm (duty cycle: ≤0.6%)
		1310/1550 nm	CW; ≤5 mW@1310/1550 nm
			PULSE: ≤200 mW@1310/1550 nm
			Pulse width: ≤20 us@1310/1550 nm (duty cycle: ≤2.5%)
735031	1M	1650 nm	CW: ≤5 mW@1650 nm
			PULSE: ≤ 32 mW@1650 nm
			Pulse width: ≤20 us@1650 nm (duty cycle: ≤2.5%)
	3R	650 nm	CW: ≤5 mW@650 nm
735032	1M	1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm
			PULSE: ≤ 200 mW@1310/1550 nm
			PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)
	3R	650 nm	CW: ≤5 mW@650 nm
735033	1M	1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm
			PULSE: ≤ 200 mW@1310/1550 nm
			PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)
	3R	650 nm	CW: ≤5 mW@650 nm

MODEL	Class	Center Wavelength	Output Power
735034	1M	1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm
			PULSE: ≤ 200 mW@1310/1550 nm
			PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)
	3R	650 nm	CW: ≤5 mW@650 nm
735035	1M	1310/1490/1550 nm	CW: ≤ 5 mW@1310/1490/1550 nm
			PULSE: ≤ 200 mW@1310/1490/1550 nm
			PULSE width: ≤ 20 us@1310/1490/1550 nm (duty cycle: ≤ 2.5%)
	3R	650 nm	CW: ≤5 mW@650 nm
735036	1M	1310/1550/1625 nm	CW: ≤ 5 mW@1310/1550/1625 nm
			PULSE: ≤ 200 mW@1310/1550/1625 nm
			PULSE width: ≤ 20 us@1310/1550/1625 nm (duty cycle: ≤ 2.5%)
735037	1M	1310/1550/1650 nm	CW: ≤ 5 mW@1310/1550/1650 nm
			PULSE: ≤ 200 mW@1310/1550 nm
			PULSE: ≤ 32 mW@1650 nm
			PULSE width: ≤ 20 us@1310/1550/1650 nm (duty cycle: ≤ 2.5%)
735038	1M	1310/1550/1625 nm	CW: ≤ 5 mW@1310/1550/1625 nm
			PULSE: ≤ 200 mW@1310/1550/1625 nm
			PULSE width: ≤ 20 us@1310/1550/1625 nm (duty cycle: ≤ 2.5%)
	3R	650 nm	CW: ≤5 mW@650 nm
735040	1M	850/1300 nm	PULSE: ≤ 50 mW@850 nm,PULSE: ≤ 100 mW@1300 nm
			PULSE width: ≤ 1 us@850 nm (duty cycle: ≤ 5%)
			≤ 5 us@1300 nm (duty cycle: ≤ 0.6%)
		1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm
			PULSE:≤ 200 mW@1310/1550 nm
			PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)
735041	1M	850/1300 nm	PULSE: ≤ 50 mW@850 nm,PULSE: ≤ 100 mW@1300 nm
			PULSE width: ≤ 1 us@850 nm (duty cycle: ≤ 5%)
			≤ 5 us@1300 nm (duty cycle: ≤ 0.6%)
		1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm
			PULSE:≤ 200 mW@1310/1550 nm
			PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)

External Dimensions

